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(54) **SYSTEM FOR DYNAMICALLY PUSHING INFORMATION TO A USER UTILIZING GLOBAL POSITIONING SYSTEM**

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(57) . **ABSTRACT**

A system is provided for directing region-specific information. The system locates and transmits information to location-specific users. A directed information system links information related to the location-specific users. The directed information system has access to a regionally defined data base for directing region-specific information to location specific-users.
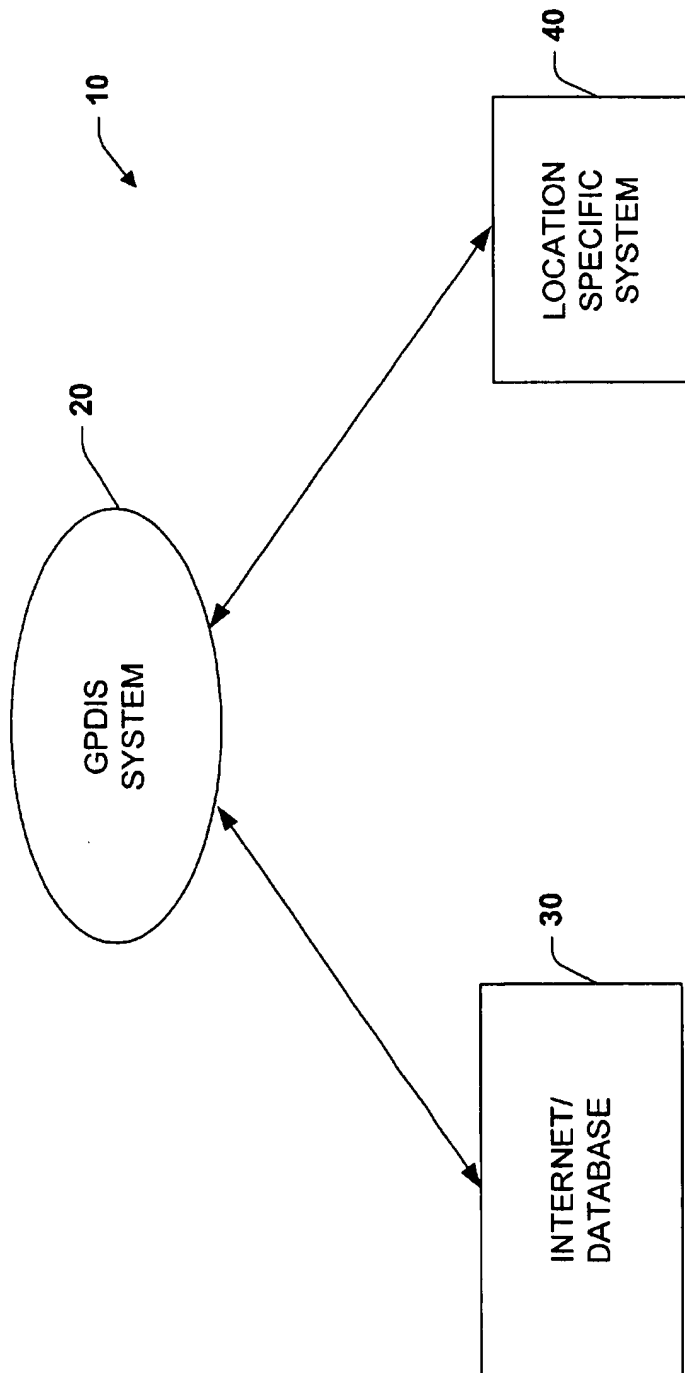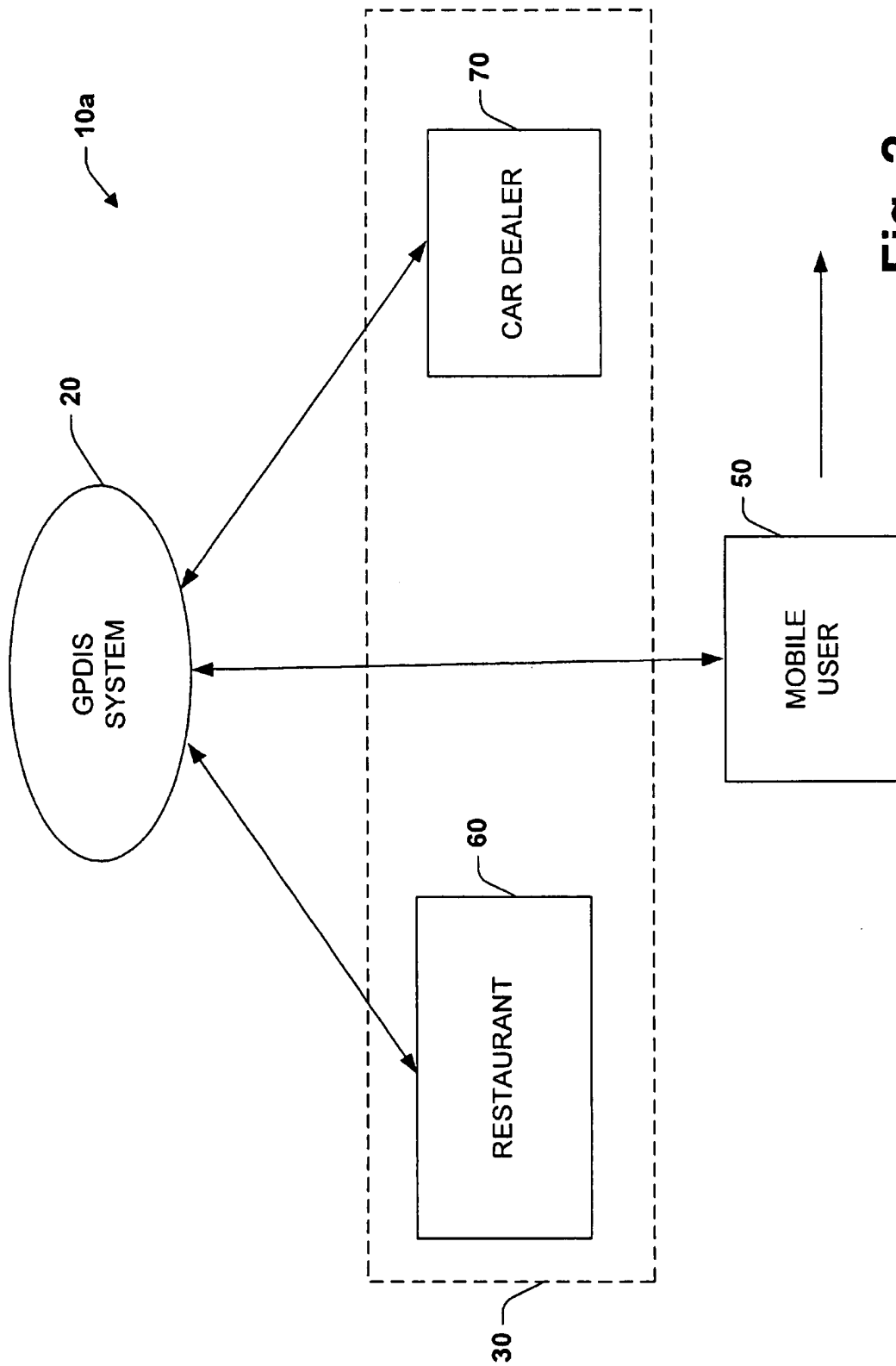
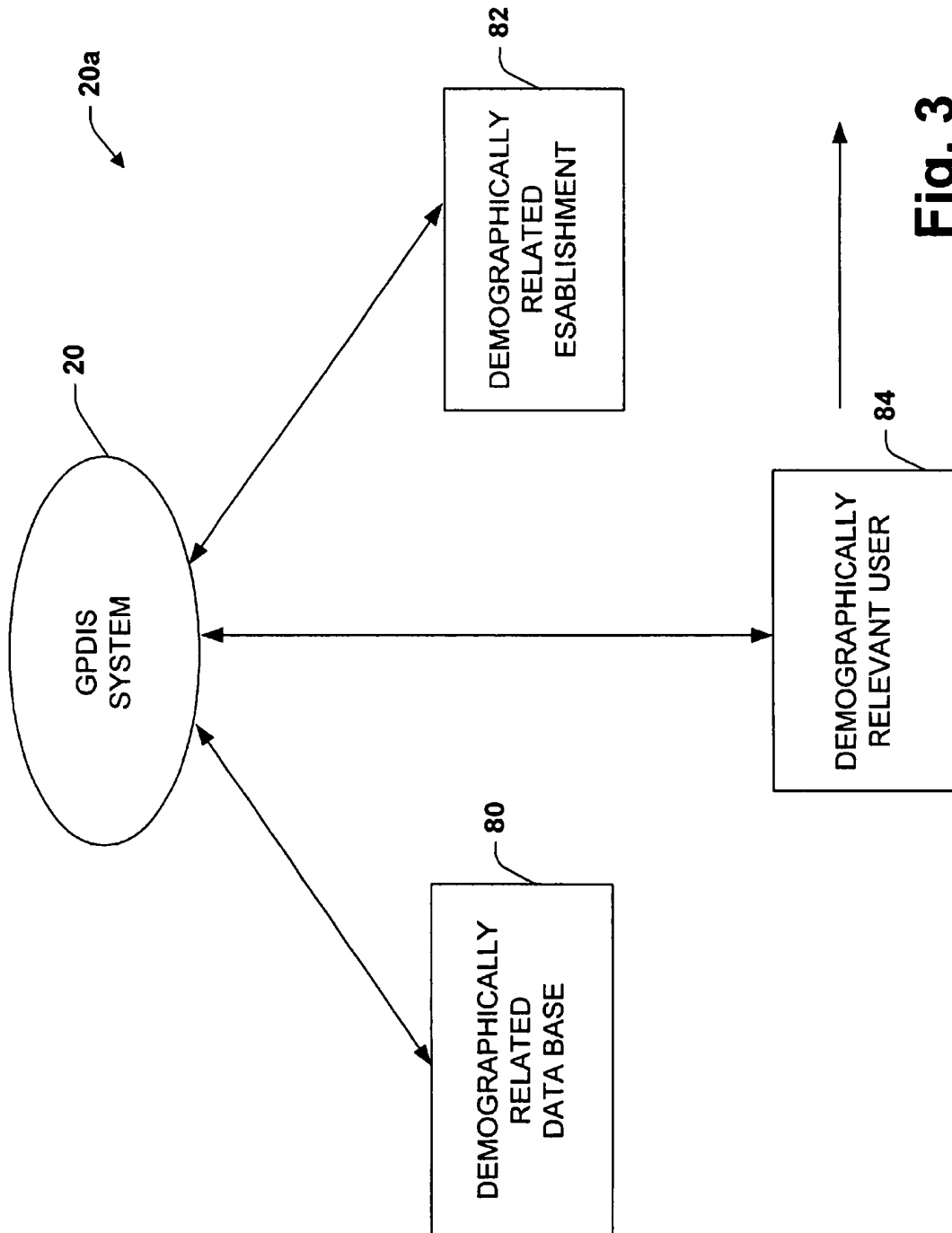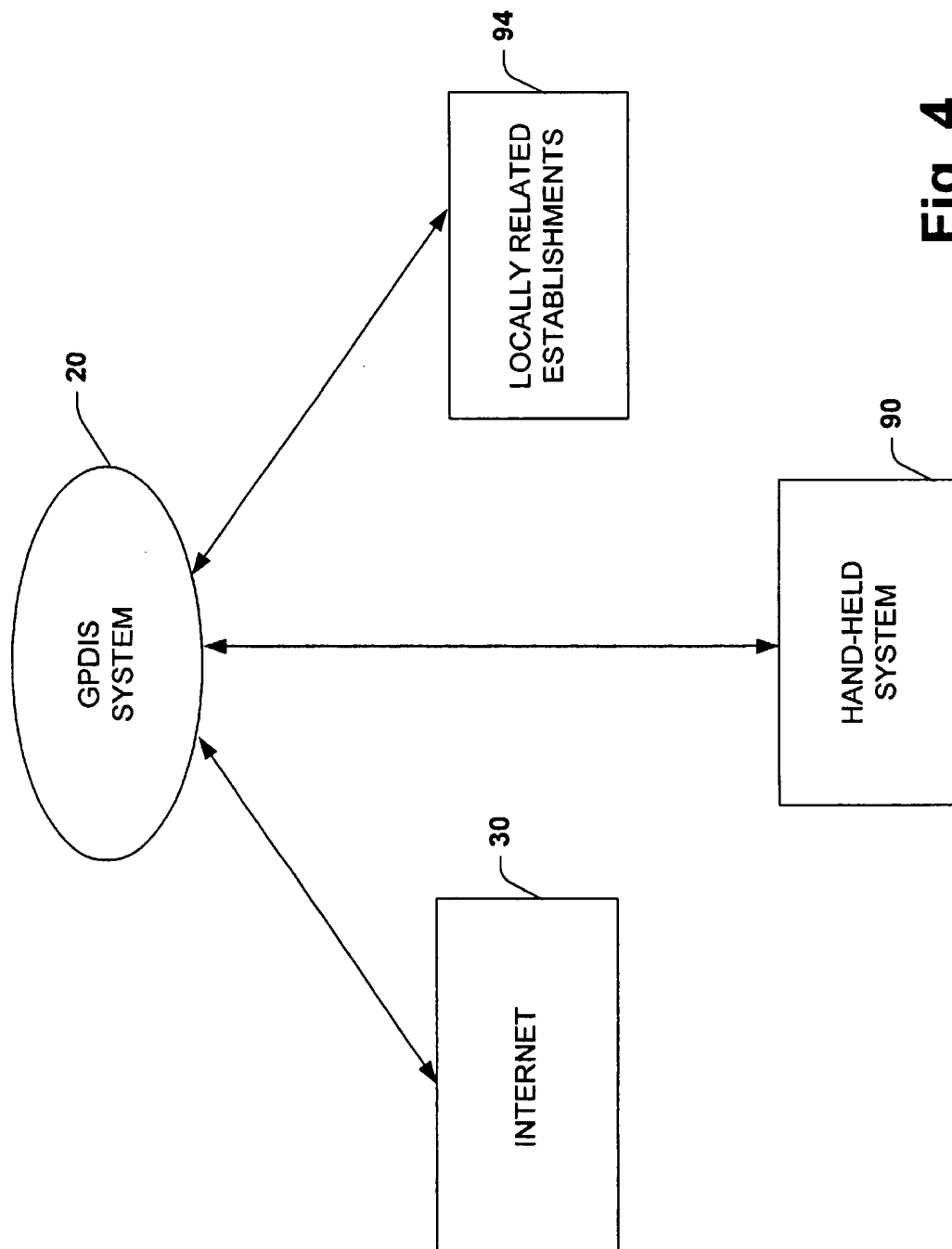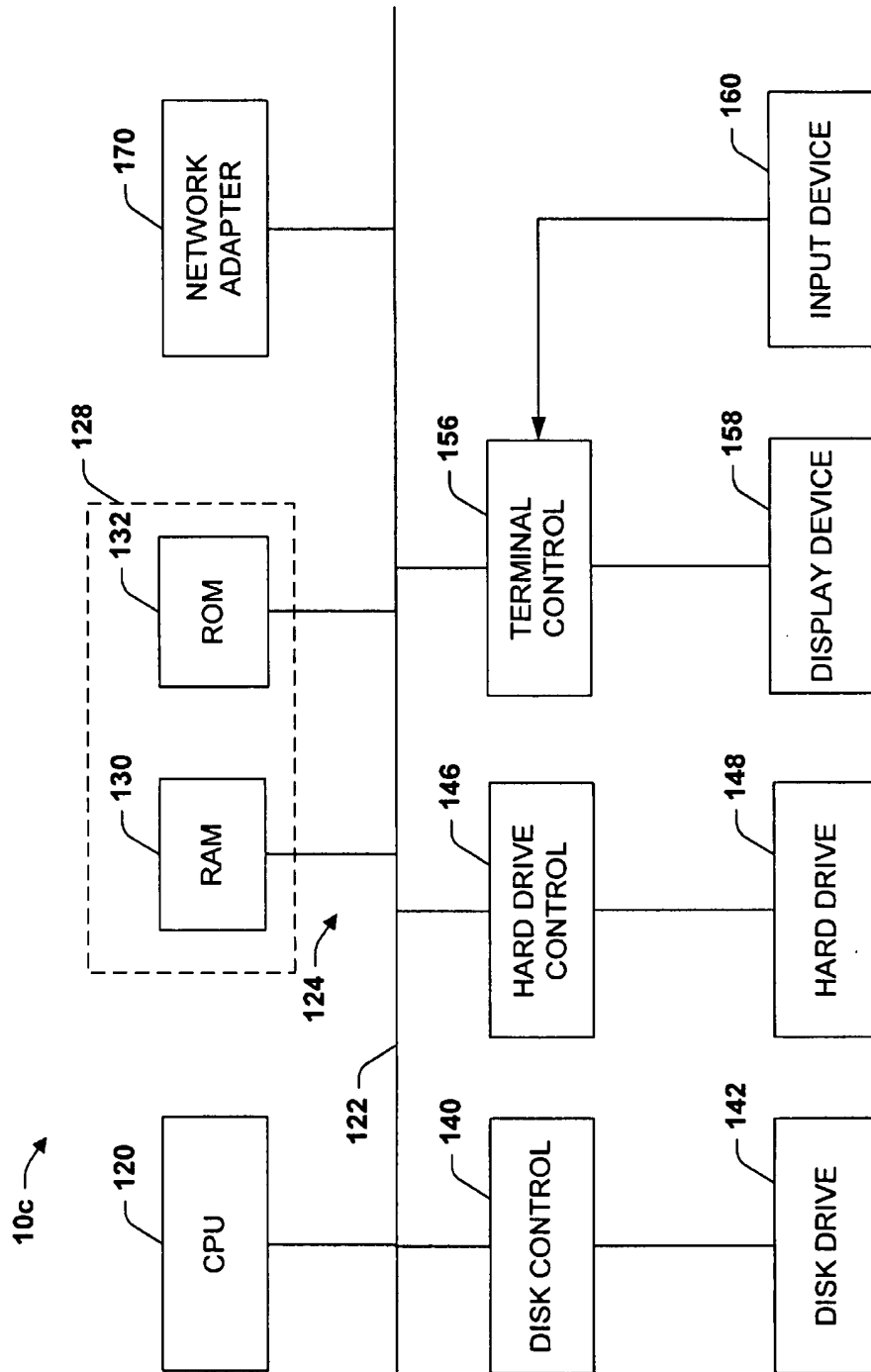**15 Claims, 5 Drawing Sheets**
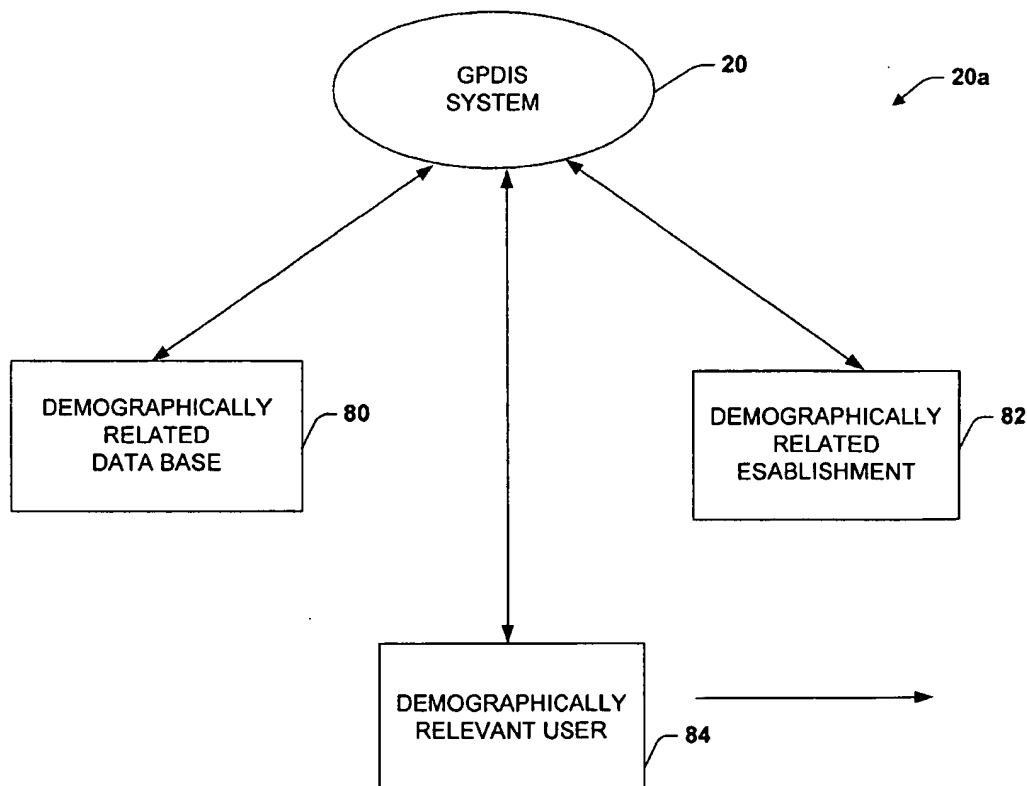
Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

SYSTEM FOR DYNAMICALLY PUSHING INFORMATION TO A USER UTILIZING GLOBAL POSITIONING SYSTEM

FIELD OF THE INVENTION

The present invention described below generally relates to a system for directing information to specific geographic locations at related points in time, and more particularly to dynamically communicating linked information to mobile users at specific geographic locations via a global satellite positioning system.

BACKGROUND OF THE INVENTION

Global positioning systems provide many conveniences for modern living. People may find themselves in completely unknown areas, and yet, they may have the comfort of knowing a system has their location pinpointed and directed on a computer screen. Still better yet, global positioning systems may provide directions for going from the unknown location to a known location. While many users of conventional global positioning systems value received location and directional information, more specific and detailed information related to the location is often needed. It is common experience to arrive at a particular destination (e.g., business or restaurant) after closing. Though a positioning system may have provided the directions to the location, it would be useful to know what the normal business hours were for example when arriving at the location. Likewise, it would be useful for a system to present all known entity types in a certain region. If a person was in an unfamiliar city for example, and needed medical care, simply knowing the present location would not direct the person to the nearest hospital. A more powerful system is therefore necessary to provide mobile users with specific information relating to the point in time the user is at a specific location. This type of system is currently not provided for with conventional systems.

In view of the above issues, it would be desirable for a system which can provide relevant information to location-specific users at relevant points in time.

SUMMARY OF THE INVENTION

The present invention provides a system for directing and receiving information to and from geographically relevant locations. The system links information from the internet or other relevant databases that is related to region-specific areas and directs the information to users situated near the region-specific areas. The possibilities for the type of information that may be linked to a geographic location is virtually limitless. In one particular instance, a store may announce a bargain sale at the same point in time that a customer is in close proximity. In another instance, a mobile user could stop at a home and receive information from a homeowner who happens to be away or leave a message for the homeowner with the message easily retrieved from a web page or e-mail system. In still yet another instance, a menu may be observed for a restaurant simply by approaching the restaurant. The type of information received from substantially any location resides in data bases, such as the Internet, linked to the location by the present invention.

The present invention also provides for bidirectional operations. For instance, a query can be made inquiring of all the hospitals located within a square mile of the present location. The query in fact may be substantially as broad or narrow as the user desires. The same hospital locations may

be queried for a given city or state, for example. As can be appreciated, this type of information may be crucial to receiving emergency health care when one is in a time critical situation and in unfamiliar surroundings.

The present invention also provides for directing information to users who meet certain criteria. Citing the example above, the store advertisement may be directed to only those drivers who are above or below a certain income level, for example. This type of demographic information may be obtained, for example, from the vehicle type (e.g., expensive sports car), from past purchasing practices, or from surveys and studies. The present invention also provides a hand-held system which allows users to receive region-specific information directed to the user's particular location. For example, a user may be situated in a new location, and the user may then request and receive information about restaurants within a defined area defined by the user. For example, the user may query for restaurants within three blocks or within the entire city and receive specific audio and/or display information related to the query.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described. The following description and the annexed drawings set forth in detail certain illustrative embodiments of the invention. These embodiments are indicative, however, of but a few of the various ways in which the principles of the invention may be employed. Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a global positioning directed information system in accordance with the present invention;

FIG. 2 is a block diagram depicting a region directed information system in accordance with the present invention;

FIG. 3 is a block diagram of a focus directed information system in accordance with the present invention;

FIG. 4 is a block diagram of a hand-held directed information system in accordance with the present invention; and

FIG. 5 is a schematic block diagram of a system in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention will now be described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout.

Referring initially to FIG. 1, a global positioning directed information system (GPDIS) 20 having whereabout information from a location-specific user system 40 is shown. The GPDIS 20 has access to an information system such as the Internet 30 for providing region-directed information to a location-specific user system 40 at any suitable point in time. It is to be appreciated that the information system may include other data bases than the Internet 30. The GPDIS 20 includes a satellite tracking system (not shown) such as a global positioning system (GPS) for locating users and transmitting information to and from the user. A directed information system (not shown) is combined with the GPS by the present invention to link the Internet system information with location-specific users. The directed information system is a bidirectional system that allows specific

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information to be linked and transmitted to specific geographic locations at specific points in time. Users may have information directed to them as they come within a predetermined proximity to certain locations or conversely, users may acquire relevant information that is related to a particular area the user may happen to be in.

The directed information system includes an object oriented computing and software system for linking relevant regional information sources to users associated with the particular region. For example, the directed information system may define sectional regions in a city and associate particular information with those regions. Whenever a location-specific user is located within a particular region, the directed information system may automatically transmit the region-specific information to the location directed by the user. The location-specific user system 40 is preferably a mobile system and includes a display and audio information system for communicating information to the user. Also, a sending/receiving system is included for communicating with the GPS system. The display system communicates a plurality of relevant visual information related to a particular region at a particular point in time. The audio system provides audio related information to the mobile system. For example, as the user approaches a predetermined distance to a gas station, an audio message may alert the driver to a sale for motor oil. The audio and visual information may be changed as often as desired by any particular location by simply changing the contents of the Internet data base. The mobile location-specific user system 40 may be implemented in a plurality of systems. For example, automobile systems, cellular telephone systems, and hand-held mobile systems known as "palm pilots" may be employed to push information to users.

Now referring to FIG. 2, a particular embodiment of the present invention is shown employing push technology. A mobile user 50 is shown passing by a restaurant 60 and a car dealership 70. The GPDIS 20 detects that the mobile user 50 is within a predetermined region that the restaurant and dealership are part of The directed information system of the GPDIS 20 links a web page or data source residing on the Internet 30 related to the restaurant 60 and pushes the information via the GPS to the mobile user 50 as the user drives by the restaurant. Likewise, the directed information system pushes car dealership information to the user as the user passes or is near the predetermined vicinity of the car dealership by linking internet information related to the car dealership.

Push technology is implemented as part of the directed information system of the GPDIS 20, however, since object oriented programming is employed, the push technology may be implemented across several systems. The technology is based in part on movement detection provided by a global positioning system. As a user moves within a predetermined distance of any particular region, the directed information system pushes information to the user in connection to the movement. Upon notification of the users whereabouts by the GPS, the directed information system links relevant information that is associated with the particular geographical location and subsequently provides the information to the GPS for transmittal to the user as the user is within the predetermined area for reception of the relevant information. As the user is moving, different audio and visual information is pushed in connection with the movement. For example, as a user is within a first geographical region, Internet data associated with a first storage data section is pushed to the user. As the user moves to a second geographical location, data associated with a second storage

data section is pushed to a user. Clearly, this sequence may be continued substantially.

Now referring to FIG. 3 another embodiment of the present invention is shown. A focus directed information system 20a is shown. The focus directed system 20a combines the directed information system mentioned above with a selectively defined criteria parameter. The selectively defined criteria may include demographic and other related criteria for linking specific information to a regionally located user. For example, as shown in FIG. 3, a demographically relevant user 84 may be riding in an expensive sports car. A demographically related data base 80 is the linked to by the GPDIS 20 that contains relevant businesses that may cater exclusively to persons above a certain income level. As the car is driven within a predetermined distance of a demographically related establishment 82, the GPDIS provides demographically related information 80 to the demographically relevant user 84. It is to be appreciated that demographic information may be obtained for users in a variety of ways. For example, users may provide survey information which is stored as part of the demographic data base. It is further to be appreciated that other information may trigger the directed information system to transmit relevant information to a user. For example, purchasers of electronic items may be sent notices as they pass within predetermined distances of the electronics store. The electronics store data base is established from past purchases of electronics.

Finally, referring to FIG. 4, another embodiment of the present invention is shown. A hand-held system 90 is shown which may wirelessly communicate with the directed information system of the GPDIS 20. The hand-held system (e.g., palm pilot) contains a computing and data input/output system (e.g., keypad, microphone, speaker) for directing queries to and receiving information from the directed information system. For example, a user may have the hand-held system 90 in a city the user is new to. The user may direct a query to the GPDIS 20 inquiring which locally related establishments 94 (e.g., restaurants, hospitals, businesses) are located within a square block of the user's present location. Upon receiving the request, the directed information system finds the related establishments within the square block, locates related Internet 30 data base information and transmits the information to the hand-held system 90 for audio or visual display. It is to be appreciated that the user may have any suitable information delivered for which the directed information system has links for the specified region. As described above, push technology may also be employed to provide information to the hand-held system.

Referring now to FIG. 5, a detailed block diagram of a computer system 10c is shown in accordance with the present invention. This system may be employed as either a client and/or a server in accordance with the present invention and may be implemented by any of the systems including the directed information system or the hand-held system described above. The computer system 10c includes a central processing unit (CPU) 120 which is coupled to a bus 122. The CPU or processor 120 can be any of a plurality of processors, such as the Pentium, Pentium 11, Pentium MMX, Pentium Merced, Power PC, SPARC, SGI_MIPS and other similar and compatible processors. It will be appreciated that since the present invention provides for a multi-platform environment as described in greater detail below, most major processors and/or computers may be employed to carry out the present invention. The processor 120 functions to perform various operations described

herein as well as for carrying out other operations related to the system 10c. The manner in which the processor 120 can be programmed to carry out the functions relating to the present invention will be readily apparent to those having ordinary skill in the art based on the description provided herein.

The bus 122 includes a plurality of signal lines 124 for conveying addresses, data and controls between the CPU 120 and a number of other system bus components. The other system bus components include a memory 128 (including a Random Access Memory (RAM) 130 and a Read Only Memory (ROM) 132) and a plurality of input/output (I/O) devices. The memory 128 serves as data storage and may store appropriate operating code to be executed by the processor 120 for carrying out the functions described herein.

The RAM 130 provides program instruction storage and working memory for the CPU 120. The ROM 132 contains software instructions known as the Basic Input/Output System (BIOS) for performing interface operations with the I/O devices. Also stored in the ROM 132 is a software routine which operates to load a boot program from the booting device. The boot program will typically be executed when the computer system 10c is powered on or when initialization of the system 10c is needed.

The I/O devices (optionally included in the mobile systems) include basic devices such as data storage devices (e.g., floppy disks, tape drives, CD ROMs, hard disks). Typically, the I/O devices communicate with the CPU 120 by generating interrupts. The CPU 120 distinguishes interrupts from among the I/O devices through individual interrupt codes assigned thereto. Responses of the CPU 120 to the I/O device interrupts differ, depending, among other things, on the devices generating the interrupts. Interrupt vectors are provided to direct the CPU 120 to different interrupt handling routines.

The interrupt vectors are generated during initialization (e.g., boot up) of the computer system 10c by execution of the BIOS. Because responses of the CPU 120 to device interrupts may need to be changed from time to time, the interrupt vectors may need to be modified from time to time in order to direct the CPU 120 to different interrupt handling routines. To allow for modification of the interrupt vectors, they are stored in the RAM 130 during operation of the computer system 10c.

A disk control subsystem 140 bidirectionally couples one or more disk drives 142 (e.g., floppy disk drives, CD-ROM drives, etc.) to the system bus 122. The disk drive 142 works in conjunction with a removable storage medium such as a floppy diskette or CD-ROM.

A hard drive control subsystem 146 bidirectionally couples a rotating fixed disk, or hard drive 148 to the system bus 122. The hard drive control subsystem 146 and hard drive 148 provide mass storage for CPU instructions and data.

A terminal control subsystem 156 is also coupled to the bus 122 and provides output to a display device 158, typically a CRT monitor or LCD display, and receives inputs from a manual input device 160 such as a keyboard. The terminal control system, the display device, and the manual input device are typically included in the mobile systems described above, however, they may be optionally included with the directed information system and global positioning systems, for example.

A network adapter 170 is provided for coupling the system 10c to a network. It is noted that the directed

information system requires a network adapter in order to access the Internet.

One of the preferred implementations of the present invention is as several sets of instructions in a code module resident in the main memory (e.g., RAM 130). Until required by the computer system 10c, the sets of instructions may be stored in another computer memory, for example, in a hard disk drive, or in a removable memory such as an optical disk for eventual use in a CDROM or a floppy disk for eventual use in the floppy disk drive.

In the preferred embodiment, the present invention is implemented via object oriented programming techniques. Object oriented programming shifts the emphasis of software development away from function decomposition and towards the recognition of units of software called "objects" which encapsulate both data and functions. Object Oriented Programming (OOP) objects are software entities comprising data structures and operations on data. Together, these elements enable objects to model virtually any realworld entity in terms of its characteristics, represented by its data elements, and its behavior represented by its data manipulation functions. In this way, objects can model concrete things like people and computers, and they can model abstract concepts like numbers or geometrical concepts.

The benefit of object technology arises out of three basic principles:

encapsulation, polymorphism and inheritance.

Objects hide or encapsulate the internal structure of their data and the algorithms by which their functions work. Instead of exposing these implementation details, objects present interfaces that represent their abstractions cleanly with no extraneous information. Polymorphism takes encapsulation one step further—the idea being many shapes, one interface. A software component can make a request of another component without knowing exactly what that component is. The component that receives the request interprets it and figures out according to its variables and data how to execute the request. The third principle is inheritance, which allows developers to reuse pre-existing design and code. This capability allows developers to avoid creating software from scratch. Rather, through inheritance, developers derive subclasses that inherit behaviors which the developer then customizes to meet particular needs.

In particular, an object includes, and is characterized by, a set of data (e.g., image data) and a set of operations (e.g., methods), that can operate on the data. Generally, an object's data is ideally changed only through the operation of the object's methods. Methods in an object are invoked by passing a message to the object (e.g., message passing). The message specifies a method name and an argument list. When the object receives the message, code associated with the named method is executed with the formal parameters of the method bound to the corresponding values in the argument list. Methods and message passing in OOP are analogous to procedures and procedure calls in procedure-oriented software environments.

However, while procedures operate to modify and return passed parameters, methods operate to modify the internal state of the associated objects (by modifying the data contained therein). The combination of data and methods in objects is called encapsulation. Encapsulation provides for the state of an object to only be changed by well-defined methods associated with the object. When the behavior of an object is confined to such well-defined locations and interfaces, changes (e.g., code modifications) in the object will have minimal impact on the other objects and elements in the system.

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Each object is an instance of some class. A class includes a set of data attributes plus a set of allowable operations (e.g., methods) on the data attributes. As mentioned above, OOP supports inheritance—a class (called a subclass) may be derived from another class (called a base class, parent class, etc.), where the subclass inherits the data attributes and methods of the base class. The subclass may specialize the base class by adding code which overrides the data and/or methods of the base class, or which adds new data attributes and methods. Thus, inheritance represents a mechanism by which abstractions are made increasingly concrete as subclasses are created for greater levels of specialization.

The use of object oriented programming provides for a framework approach to object based application development. The present invention employs abstract classes, which are designs of sets of objects that collaborate to carry out a set of responsibilities. Frameworks are essentially groups of interconnected objects and classes that provide a prefabricated structure for a working application.

Accordingly, a user interface framework in accordance with the present invention may provide the support and default behavior of user display windows, tool bars, command bars, etc. By basing the framework on object oriented technology, the behavior can be inherited and oven ridden to allow developers to extend the framework and create customized solutions in the push technology arena. As a result, significant advantages are achieved over employing conventional programming techniques used in the image analysis area since a programmer is not required to change original code but rather to extend from existing code. Moreover, the developers no longer have to work blindly through layers of code because the framework provides architectural guidance and modeling and also frees the programmers to supply specific actions unique to the image analysis problem domain.

According to an exemplary embodiment of the present invention, Java is employed to carry out the present invention. Java is an object-oriented, distributed, secure, architecture neutral language. Java provides for object-oriented design which facilitates the clean definition of interfaces and makes it possible to provide reusable "software ICs." Java has an extensive library of routines for copying easily with TCP/IP protocols like HTTP and FTP. Java applications can open and access objects across a network via URLs with the same ease to which programmers are accustomed to accessing a local file system.

Furthermore, Java utilizes "references" in place of a pointer model and so eliminates the possibility of overwriting memory and corrupting data. Instead of pointer arithmetic that is employed in many conventional systems, the Java "virtual machine" mediates access to Java objects (attributes and methods) in a type-safe way. In addition, it is not possible to turn an arbitrary integer into a reference by casting (as would be the case in C and C++ programs). In so doing, Java enables the construction of virus-free, tamper-free systems. The changes to the semantics of references make it virtually impossible for applications to forge access to data structures or to access private data in objects that they do not have access to. As a result, most activities of viruses are precluded from corrupting a Java system.

Java affords for the support of applications on networks. Networks are composed of a variety of systems with a variety of CPU and operating system architectures. To enable a Java application to execute anywhere on the network, a compiler generates an architecture neutral object file format—the compiled code is executable on many

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processors, given the presence of the Java runtime system. Thus, Java is useful not only for networks but also for single system software distribution. In the present personal computer market, application writers have to produce versions of their applications that are compatible with the IBM PC and with the Apple Macintosh. However, with Java, the same version of the application runs on all platforms. The Java compiler accomplishes this by generating bytecode instructions which have nothing to do with a particular computer architecture. Rather, they are designed to be both easy to interpret on any machine and easily translated into native machine code on the fly.

Being architecture neutral, the "implementation dependent" aspects of the system are reduced or eliminated. The Java virtual machine (VM) can execute Java bytecodes directly on any machine to which the VM has been ported. Since linking is a more incremental and lightweight process, the development process can be much more rapid and exploratory. As part of the bytecode stream, more compile-time information is carried over and available at runtime.

Thus, the use of Java in the present invention provides a server to send region-specific and related information programs over the network as easily as traditional servers send data. These programs can display and manipulate data, such as related advertising information on a client computer. The present invention through the use of Java supports execution on multiple platforms. That is the same programs can be run on substantially all computers—the same Java program can work on a Macintosh, a Windows 95 machine, a Sun workstation, etc. It should be appreciated, however, that a Java stand-alone application may be constructed to achieve a substantially equivalent result. Although the present invention is described with respect to employing Java, it will be appreciated that any suitable programming language may be employed to carry out the present invention.

The present invention instantiates Java client classes by name at run time to implement client interfaces to changing server components. That is the present invention integrates the Java programming to communicate with services distributed on various computers (e.g., mobile and stationary) on the intranet through the use of distributed object technology, which is discussed in greater detail below.

Using this technology, a related task can be performed by the computer most optimally suited for it, and these decisions can be made dynamically. For example, if a given computer that provides a service is busy or down, the system will find an alternate source for that service, and provide it to the client immediately. The combination of Java-based client software and distributed object based services leads to a client/server system that facilitates push technology substantially.

Most current and past object oriented programming (OOP) systems are restricted to utilizing and making calls to objects within the same address space as the process utilizing or calling the objects. That is, a process cannot typically access objects located within other processes including where those other processes are located on the same or different host computers. However, distributed OOP systems allow processes to access objects located in remote address spaces located in the same or other host systems. A standard for such distributed OOP systems currently exists called Common Object Request Broker Architecture (CORBA) and is described in The Common Object Request Broker: Architecture and Specification, published by the Object Management Group (OMG), which is hereby incorporated by reference. This architecture allows a process to make calls to objects in other address spaces typically by constructing the necessary communication paths during compilation.

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In simple items, CORBA allows applications to interact and communicate closely at a higher level of abstraction than merely sending packets of data back and forth. Applications in a heterogeneous computing environment can interact without worries of how the two different machines and operating systems can interface. Thus, CORBA specifies a system which provides interoperability between objects in a heterogeneous distributed environment and in a way transparent to the programmer. It is to be appreciated that CORBA is but one way of communicating with distributed objects. For example, a DCOM (Distributed Component Object Model) developed by Microsoft may be employed to accomplish the same task.

What has been described above are prefer led embodiments of the present invention. It is, of course, not possible to describe every conceivable combination of components or methodologies for purposes of describing the present invention, but one of ordinary skill in the art will recognize that many further combinations and permutations of the present invention are possible. Accordingly, the present invention is intended to embrace all such alterations, modifications and variations that fall within the spirit and scope of the appended claims.

What is claimed is:

1. A system for directing region-specific information; comprising:

   a system for locating and transmitting information to location-specific users; and

   a directed information system for linking information related to the location specific users, the directed information system having access to a regionally defined data base for directing region-specific information to location-specific users, and employing push technology to push information to the location-specific users.

2. The system of claim 1 wherein a GPS is employed to locate users and to transmit information.

3. The system of claim 1 wherein queries are made of the directed information system.

4. The system of claim 1 employing object oriented technology.

5. The system of claim 1 including display and audio systems for receiving information from the directed information system.

6. The system of claim 1 wherein the directed information system links to the Internet for directing information to location-specific users.

7. A system for directing region-specific information; comprising:

   a system for locating and transmitting information to location-specific users;

   a directed information system for linking information related to the locationspecific users;

   wherein the directed information system has access to a regionally defined data base for directing region specific information to location specific users; and

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   the directed information system pushes information at points in time when users are located within a related specific region.

8. A system for directing region-specific information; comprising:

   a system for locating and transmitting information to location specific users located by selectively defined criteria;

   a directed information system for linking selectively defined criteria related to the location-specific users;

   wherein the directed information system has access to a regionally defined data base for directing region-specific information to location-specific users; and

   the directed information system pushes information at points in time when users are located within a related specific region.

9. A hand-held system for receiving region-specific information; comprising:

   a system for locating and transmitting information to location-specific users;

   a directed information system for linking information related to the locationspecific users, the directed information system having access to a regionally defined data base for directing region-specific infonmation to location-specific users, and employing push technology to push information to the location-specific users; and

   wherein the hand-held system may query the directed information system for region-specific information.

10. A system for directing information; comprising:

   a system for detecting movement of mobile users and pushing information to the users;

   wherein data is pushed to a user is in a first geographical region associated with a first storage data section as the user moves within a predetermined distance of the first geographical region; and

   wherein data is pushed to the user in a second geographical region associated with a second storage data section as the user moves from the first geographical region to within a predetermined distance of the second geographical region.

11. The system of claim 10 wherein a GPS is employed to detect movement of mobile users.

12. The system of claim 10 wherein a directed information system pushes data.

13. The system of claim 10 employing object oriented technology.

14. The system of claim 10 including display and audio systems for receiving information from the system.

15. The system of claim 10 wherein the system links to the Internet for finding storage data sections.

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